

# RCRA Facility Investigation Proposed Soil Cleanup Levels

Boeing—Plant 2  
Seattle/Tukwila, Washington

FILE COPY

Submitted To:  
The Boeing Company  
Energy and Environmental Affairs

August 1998

USEPA RCRA



3013410

RCRA Facility Investigation  
Proposed Soil Cleanup Levels

Boeing—Plant 2  
Seattle/Tukwila, Washington

*Submitted to:*

The Boeing Company  
Energy and Environmental Affairs  
Seattle, Washington

August 1998

*Prepared by:*

Roy F. Weston, Inc.  
700 Fifth Avenue  
Suite 5700  
Seattle, Washington 98104

WO 3709-034-300-3930

## TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
<b>1. INTRODUCTION.....</b>	<b>1</b>
<b>2. EXPOSURE PATHWAYS.....</b>	<b>1</b>
2.1 Soil .....	1
2.2 Groundwater.....	2
<b>3. CONSTITUENTS OF CONCERN.....</b>	<b>3</b>
<b>4. PROPOSED SOIL CLEANUP LEVELS .....</b>	<b>3</b>
<b>5. PROPOSED POINT OF COMPLIANCE .....</b>	<b>4</b>
<b>6. COMPARISON OF PLANT 2 SOIL DATA TO PROPOSED MEDIA CLEANUP     LEVELS.....</b>	<b>4</b>
<b>7. SUMMARY.....</b>	<b>5</b>
<b>REFERENCES .....</b>	<b>6</b>
<b>APPENDIX A—SURFACE WATER CRITERIA SCREENING LEVELS</b>	



## **LIST OF TABLES**

<u>Table</u>	<u>Title</u>
1	PMCLs for Soil Based on Groundwater Discharge to the Duwamish Waterway
2	COCs That Exceed Proposed Media Cleanup Levels

## **LIST OF FIGURES**

<u>Figure</u>	<u>Title</u>
1	Boeing Plant 2 Historical and RFI Soil Samples Exceeding Proposed Media Cleanup Levels



## **PROPOSED SOIL CLEANUP LEVELS BOEING PLANT 2**

### **1. INTRODUCTION**

This report presents the proposed media cleanup levels (PMCLs) and point of compliance for soil at Boeing Plant 2 (the Facility) located at 7755 East Marginal Way South in Seattle, Washington. This report fulfills the requirements for a human health and environmental evaluation of the soil at the Facility under the Administrative Order on Consent (Order) issued by the U.S. Environmental Protection Agency (EPA) to The Boeing Company (Boeing) under the authority of Section 3008(h) of the Resource Conservation and Recovery Act of 1976 (RCRA), as amended [42 USC 6928(h)]. The Order [RCRA Docket No. 1092-01-22-3008(H)], which became effective on 18 January 1994, identified activities necessary to correct or evaluate actual or potential threats to human health and/or the environment resulting from the release or potential release of hazardous constituents at or from the Facility. As required by the Order, this document proposes media cleanup levels for use in the Corrective Measures Study (CMS).

A health evaluation for upland soil at the Facility was prepared in May 1996 to identify the constituents of concern in upland soil and to assess the need for development of soil cleanup levels that are protective of human health (WESTON, 1996a). A groundwater human health and environmental evaluation has been conducted to develop proposed media cleanup levels and points of compliance for all hazardous constituents detected at levels of concern in Facility groundwater (WESTON, 1998).

As a followup to the upland soil health evaluation, this report evaluates the soil to groundwater pathway for the identified constituents of concern (COCs) in the upland soil and proposes soil cleanup levels that are protective of groundwater quality at the Facility.

### **2. EXPOSURE PATHWAYS**

#### **2.1 Soil**

As part of the RCRA Facility Investigation (RFI) Work Plan (WESTON, 1994), Boeing identified a process that would be followed to identify human health-based cleanup levels for upland soil. For the first step of the process, promulgated standards for soil were reviewed and found to be inapplicable to conditions at the Facility. Next, development of Facility-specific cleanup levels was pursued. However, since the site is completely paved or covered with buildings (except small landscaped areas) and there are comprehensive institutional controls in place, complete exposure pathways for direct contact with contaminated soil were not currently present and would not be present in the future. Based on the lack of potential exposure to contaminated soil, human health-protective cleanup levels for direct exposure to soil were considered to be inappropriate for the Facility (WESTON, 1996a).



## 2.2 Groundwater

The soil to groundwater pathway, however, was a potential exposure route for hazardous constituents in soil. Impacted soil exists at the Facility within three areas or zones. Releases at the surface may have affected soil in the vadose zone above the water table or may have migrated downward into the saturated zone. In some locations, particularly the southwest yard area adjacent to the Duwamish Waterway, hazardous constituents may have been contained within fill materials both above and below the water table. Each area has implications for exposure pathways, effects on groundwater, and ultimately contributions to surface water in the Duwamish Waterway. The properties of the particular constituents of concern will also be critical in predicting subsurface fate and transport processes.

Where the COCs are found in the subsurface will determine their contribution of contaminants to the groundwater pathway and the environment. Contaminants that are in the vadose zone above the water table are less susceptible to leaching than soil in the saturated zone. Normally, contaminated soil that exists in a vadose zone might be considered susceptible to leaching by infiltrating water, causing mass transfer to the groundwater system. However, due to the presence of pavement, buildings, and institutional controls at the Facility, subsurface soil is isolated and leaching by infiltrating water is minimized. Some minor leakage from subsurface storm sewer drainpipes may occur, but will be limited to the vicinity of the pipes and the associated backfill materials. Therefore, contaminated soil above the water table can be considered relatively isolated from the groundwater system compared to soil below the water table.

Soil found below the water table is in constant contact with groundwater that migrates toward the Duwamish Waterway. Partitioning and leaching of constituents from contaminated soil to groundwater would be expected to occur in this area in proportion to the properties of the particular constituent of concern. This type of area is considered to be more relevant to groundwater remediation than the development of soil cleanup levels and will be considered while assessing groundwater remedies during the CMS.

Fill containing hazardous constituents both above and below the water table could potentially be subjected to leaching by infiltration, flushing by groundwater, and, if near the Duwamish Waterway, flushing by tidal fluctuations. COCs have been identified in a narrow strip of shoreline in the southwest yard area where these processes may be occurring.

Groundwater impacts at the Facility were described in the RFI Groundwater Human Health and Environmental Evaluation Report (WESTON, 1998). Remedial measures to address impacted groundwater and off-site discharge of groundwater to the Duwamish Waterway will be evaluated during the CMS. In most cases, elevated constituent concentrations in soil are associated with groundwater contamination sources. Therefore, many areas of soil impact that are not protective of groundwater quality will be addressed through the groundwater remediation phase of the CMS. The proposed soil cleanup levels developed in this document will also aid design of appropriate groundwater remedies in the CMS.



### 3. CONSTITUENTS OF CONCERN

COCs for Facility soil are defined as all constituents detected in at least one soil sample, which includes 33 volatile organic chemicals, 37 semivolatile organic chemicals, polychlorinated biphenyls (PCBs), total petroleum hydrocarbons (TPH), and 27 metals. Soil COCs are listed in Table 1. Soil COC data are provided in the RFI Soil Investigation Interim Report (WESTON, 1996b).

### 4. PROPOSED SOIL CLEANUP LEVELS

Soil cleanup levels are proposed for the protection of human health and the environment via migration of COCs from soil to groundwater and ultimately to surface water receptors in the Duwamish Waterway adjacent to the Facility. The PMCLs for soil will not directly or indirectly violate state standards and federal criteria for the protection of surface water. The related media of concern at the Facility are groundwater and the surface water into which groundwater discharges. Groundwater at the Facility is not a potable drinking water source, as described in the RFI Groundwater Human Health and Environmental Evaluation Report (WESTON, 1998). Therefore, protection of surface water quality in the Duwamish Waterway through acceptable groundwater quality is the primary objective for establishing PMCLs. EPA (40 CFR 131) and State of Washington surface water standards (WAC 173-201 and WAC 173-340-730) are applicable to the Duwamish Waterway. These criteria/standards have been developed as generic, conservative values that are protective of aquatic life as well as humans who may be exposed due to consumption of fish.

In Washington state, WAC 173-340-740 (3)(a)(ii)(A) and WAC 173-340-745 (4)(a)(ii)(A) of the regulations implementing the Model Toxics Control Act (MTCA) require the setting of soil standards that are protective of groundwater quality, as follows:

For individual hazardous substances or mixtures, concentrations that are equal to or less than one hundred times the ground water cleanup level established in accordance with WAC 173-340-720 unless it can be demonstrated that a higher soil concentration is protective of ground water at the site [WAC 173-340-740(3)(ii)(A)].

The Washington Department of Ecology (Ecology) is also preparing guidance for demonstrating that use of an alternative to its “one hundred times” soil-to-groundwater ratio is appropriate. Pending final Ecology guidance, the proposed cleanup levels for soil have been developed using the “one hundred times” approach in the MTCA regulations.

Accordingly, the following approach has been used to develop PMCLs:

- i) Except for certain inorganics, proposed groundwater cleanup levels are multiplied by 100 to derive PMCLs for soil. The PMCLs for groundwater, as discussed in the RFI Groundwater Human Health and Environmental Evaluation Report (WESTON, 1998), are based on the protection of water quality in the Duwamish Waterway. As described therein, PMCLs for groundwater are based on the lowest appropriate surface water



criteria among the following: marine acute criteria, marine chronic criteria, and human health-based criteria that are protective of human consumption of fish in the Duwamish Waterway.

- ii) For inorganics, proposed soil cleanup levels will be based on regional background levels (Ecology, 1994), if the background levels are greater than the soil criteria developed from ambient surface water quality criteria. Site-specific background concentrations for soil could not be determined in the RFI because the entire Facility is underlain by anthropogenic fill.

The resulting soil cleanup levels developed using the above method are shown in Table 1. Regional background values were used as PMCLs for the following inorganic constituents: aluminum, arsenic, beryllium, cadmium, chromium, copper, lead, manganese, mercury, nickel, and zinc.

## 5. PROPOSED POINT OF COMPLIANCE

The proposed point of compliance for soil at the Facility is the soil interval from a depth of zero to approximately 12 feet below ground surface (depth to groundwater). This interval was selected because it represents the soil vadose zone above the groundwater table and is potentially susceptible to leaching and translocating hazardous constituents to groundwater. Impacted soil below the water table will be handled as a groundwater issue in the CMS.

## 6. COMPARISON OF PLANT 2 SOIL DATA TO PROPOSED MEDIA CLEANUP LEVELS

Facility soil data from a depth of zero to 12 feet below ground surface were compared to the PMCLs to determine those sample stations that exceeded the PMCLs and will therefore require further evaluation in the CMS. Table 2 identifies the COCs that exceeded the PMCLs.

As shown in Table 2, 8 VOC compounds, 17 semivolatile (BNA) compounds, several PCB mixtures, and 17 inorganic constituents exceeded the proposed soil cleanup levels. The frequency of exceedance of the PMCLs was less than 10 percent for all except the following constituents:

- Chrysene
- Aroclor 1260
- Aroclor 1262
- Total PCBs
- Cadmium
- Chromium



- Copper
- Cyanide
- Lead
- Mercury
- Zinc

Figure 1 presents those soil sample stations that have COC concentrations exceeding one or more PMCLs.

## 7. SUMMARY

At the Facility the primary pathway of exposure for soil contaminants is from the discharge of groundwater to surface water of the Duwamish Waterway. Human-health risk has previously been shown to be acceptable due to site pavement, buildings, and institutional controls acting as barriers preventing direct contact with contaminated soil (WESTON, 1994).

Proposed soil cleanup levels have been developed to limit impacts to groundwater quality that are based on the “one hundred times” soil-to-groundwater ratio from MTCA. The proposed soil cleanup levels were developed based on concentrations that are 100 times the groundwater concentrations calculated to protect the Duwamish Waterway (WESTON, 1998). In cases where calculated criteria were less than regional background levels for soil, the background soil values were used.

These proposed soil cleanup levels will be used in the CMS to determine appropriate remedies to address contaminated soil and groundwater at the Facility. Other methods to modify site-specific soil cleanup criteria may be evaluated during the CMS including Ecology guidance on identifying site-specific soil-to-groundwater ratios appropriate for conditions at the Facility and/or unit specific fate and transport modeling.

## REFERENCES

Ecology (Washington State Department of Ecology). 1994. Natural Background Soil Metals Concentrations in Washington State. No. 94-115. Toxics Cleanup Program, Washington State Department of Ecology, Olympia, WA.

EPA (U.S. Environmental Protection Agency). 1996a. Integrated Risk Information System (IRIS). Environmental Criteria and Assessment Office, U.S. Environmental Protection Agency, Cincinnati, OH. (Most current 1996 update.)

EPA. 1996b. Soil Screening Guidance: Technical Background Document. EPA/540/R-95/128. Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, DC.



WESTON (Roy F. Weston, Inc.). 1998. RFI Groundwater Human Health and Environmental Evaluation. Prepared for The Boeing Company, Corporate Safety, Health and Environmental Affairs, Seattle, WA. Roy F. Weston, Inc., Seattle, WA.

WESTON. 1996a. RFI Health Evaluation for Upland Soil. Prepared for The Boeing Company, Corporate Safety, Health and Environmental Affairs, Seattle, WA. Roy F Weston, Inc., Seattle, WA.

WESTON. 1996b. RCRA Facility Investigation Soil Investigation Interim Report. Prepared for The Boeing Company, Corporate Safety, Health and Environmental Affairs, Seattle, WA. Roy F. Weston, Inc., Seattle, WA.

WESTON. 1994. RCRA Facility Investigation Work Plan Boeing Plant 2 Seattle/Tukwila, Washington. Prepared for the Boeing Company, Corporate Safety, Health and Environmental Affairs, Seattle, WA. Roy F. Weston, Inc., Seattle, WA.



## TABLES



Table 1—PMCLs for Soil Based on Groundwater Discharge to Duwamish Waterway

Constituent	CAS No.	GW PMCL (µg/L)	GW PMCL x 100 (mg/kg)	Puget Sound Soil Background (mg/kg)	Soil PMCL (mg/kg)
<b>VOCs</b>					
1,1,1-Trichloroethane	71-55-6	31,200 <sup>b</sup>	3,120	--	3,120
1,1,2,2-Tetrachloroethane	79-34-5	6.5	0.65	--	0.65
1,1,2-Trichlorotrifluoroethane	76-13-1	12,962,963 <sup>b</sup>	1,296,296	--	1,296,296
1,1,2-Trichloroethane	79-00-5	25	2.5	--	2.5
1,1-Dichloroethane	75-34-3	63,234 <sup>b</sup>	6,323	--	6,323
1,1-Dichloroethene	75-35-4	1.9	0.19	--	0.19
1,2-Dichloroethane	107-06-2	59	5.9	--	5.9
1,2-Dichloroethene (total)	540-59-0	9,333 <sup>b</sup>	933	--	933
1,2-Dichloropropane <sup>e</sup>	78-87-5	23.2	2.3	--	2.3
2-Butanone	78-93-3	NA <sup>c</sup>	--	--	NA <sup>c</sup>
2-Hexanone <sup>e</sup>	591-78-6	NA <sup>a</sup>	--	--	NA <sup>a</sup>
4-Methyl-2-Pentanone	108-10-1	NA <sup>a</sup>	--	--	NA <sup>a</sup>
Acetone	67-64-1	2,552,858 <sup>b</sup>	255,286	--	255,286
Benzene	71-43-2	43	4.3	--	4.3
Bromodichloromethane	75-27-4	28	2.8	--	3
Bromoform	75-25-2	219	21.9	--	21.9
Carbon Disulfide	75-15-0	NA <sup>c</sup>	--	--	NA <sup>c</sup>
Carbon Tetrachloride	56-23-5	2.7	0.27	--	0.27
Chlorobenzene	108-90-7	129	12.9	--	12.9
Chloroethane	75-00-3	230,000	23,000	--	23,000
Chloroform	67-66-3	283	28.3	--	28.3
cis-1,2-Dichloroethene	156-59-2	16,204 <sup>b</sup>	1,620	--	1,620
Ethylbenzene	100-41-4	430	43	--	43
Methylene Chloride	75-09-2	960	96	--	96
Styrene <sup>e</sup>	100-42-5	NA <sup>a</sup>	--	--	NA <sup>a</sup>
Tetrachloroethene	127-18-4	8.9	0.89	--	0.89
Toluene	108-88-3	5,000	500	--	500
trans-1,2-Dichloroethene	156-60-5	32,800	3,280	--	3,280
Trichloroethene	79-01-6	55	5.5	--	5.5
Trichlorofluoromethane	75-69-4	6,400	640	--	640
Vinyl Chloride	75-01-4	2.9	0.29	--	0.29
Total Xylene	1330-20-7	87,712 <sup>b</sup>	8,771	--	8,771
o-Xylene	95-47-6	154,155 <sup>b</sup>	15,416	--	15,416
m,p-Xylene	1330207-MP	87,712 <sup>b</sup>	8,771	--	8,771
<b>BNAs</b>					
1,2,4-Trichlorobenzene <sup>e</sup>	120-82-1	227	22.7	--	22.7
1,2-Dichlorobenzene	95-50-1	1,970	197	--	197
2,4-Dimethylphenol	105-67-9	553	55.3	--	55.3
2-Chloronaphthalene <sup>e</sup>	91-58-7	NA <sup>a</sup>	--	--	NA <sup>a</sup>
2-Methylnaphthalene	91-57-6	NA <sup>a</sup>	--	--	NA <sup>a</sup>
2-Methylphenol	95-48-7	17,057 <sup>b</sup>	1,706	--	1,706
4-Chloro-3-methylphenol	59-50-7	30	3	--	3
4-Methylphenol	106-44-5	1,706 <sup>b</sup>	171	--	171
Benzoic acid <sup>e</sup>	65-85-0	NA <sup>a</sup>	--	--	NA <sup>a</sup>
bis(2-Ethylhexyl)phthalate	117-81-7	3.5	0.35	--	0.35
Butylbenzylphthalate <sup>e</sup>	85-68-7	1,250	125	--	125



Table 1—PMCLs for Soil Based on Groundwater Discharge to Duwamish Waterway

Constituent	CAS No.	GW PMCL (µg/L)	GW PMCL x 100 (mg/kg)	Puget Sound Soil Background (mg/kg)	Soil PMCL (mg/kg)
Carbazole	86-74-8	NA <sup>a</sup>	--	--	NA <sup>a</sup>
Di-n-butylphthalate <sup>e</sup>	84-74-2	2,910	291	--	291
Di-n-octylphthalate	117-84-0	NA <sup>a</sup>	--	--	NA <sup>a</sup>
Dibenzofuran	132-64-9	NA <sup>a</sup>	--	--	NA <sup>a</sup>
Diethylphthalate	84-66-2	2,900	290	--	290
Dimethylphthalate <sup>e</sup>	131-11-3	72,000	7,200	--	7,200
Hexachlorobutadiene <sup>e</sup>	87-68-3	29.1	2.9	--	2.9
N-Nitrosodiphenylamine <sup>e</sup>	86-30-6	9.73	0.973	--	0.973
Phenol	108-95-2	5,800	580	--	580
<b>LPAHs</b>					
Naphthalene	91-20-3	2,350	235	--	235
Acenaphthylene	208-96-8	300	30	--	30
Acenaphthene	83-32-9	643	64.3	--	64.3
Fluorene	86-73-7	300	30	--	30
Phenanthrene	85-01-8	--	--	--	NA <sup>a</sup>
Anthracene	120-12-7	300	30	--	30
Total LPAH	TOTAL-LPAH	300	30	--	30
<b>HPAHs</b>					
Fluoranthene	206-44-0	90	9	--	9
Pyrene	129-00-0	300	30	--	30
Benzo(a)anthracene <sup>e</sup>	56-55-3	0.029	0.0029	--	0.0029
Chrysene <sup>e</sup>	218-01-9	0.029	0.0029	--	0.0029
Benzo(b)fluoranthene <sup>e</sup>	205-99-2	0.029	0.0029	--	0.0029
Benzo(k)fluoranthene <sup>e</sup>	207-08-9	0.029	0.0029	--	0.0029
Benzo(a)pyrene <sup>e</sup>	50-32-8	0.029	0.0029	--	0.0029
Indeno(1,2,3-cd)pyrene <sup>e</sup>	193-39-5	0.029	0.0029	--	0.0029
Dibenzo(a,h)anthracene <sup>e</sup>	53-70-3	0.029	0.0029	--	0.0029
Benzo(g,h,i)perylene <sup>e</sup>	191-24-2	NA <sup>a</sup>	--	--	NA <sup>a</sup>
Total HPAH	TOTAL-HPAH	68 <sup>b</sup>	6.8	--	6.8
<b>PCBs</b>					
Aroclor 1016/1242	A1016/1242	0.000045	0.0000045	--	0.0000045
Aroclor 1242	53469-21-9	0.000045	0.0000045	--	0.0000045
Aroclor 1248 <sup>e</sup>	12672-29-6	0.000045	0.0000045	--	0.0000045
Aroclor 1254	11097-69-1	0.000045	0.0000045	--	0.0000045
Aroclor 1260	11096-82-5	0.000045	0.0000045	--	0.0000045
Aroclor 1262 <sup>e</sup>	37324-23-5	0.000045	0.0000045	--	0.0000045
Total PCB	TOTAL-PCB	0.000104	0.0000104	--	0.0000104
<b>Total Inorganics</b>					
Aluminum	7429-90-5	NA <sup>a</sup>	--	32,581	32,581
Antimony	7440-36-0	500	50	--	50
Arsenic	7440-38-2	0.098	0.0098	7.3	7.3
Barium	7440-39-3	NA <sup>c</sup>	--	--	NA <sup>c</sup>
Beryllium	7440-41-7	0.079	0.0079	0.6	0.6
Cadmium	7440-43-9	9.3	0.93	0.8	0.8
Calcium	7440-70-2	NA <sup>a,d</sup>	--	--	NA <sup>a,d</sup>
Chromium	7440-47-3	50	5	48.2	48.2
Cobalt	7440-48-4	NA <sup>a,d</sup>	--	--	NA <sup>a,d</sup>



**Table 1—PMCLs for Soil Based on Groundwater Discharge to Duwamish Waterway**

Constituent	CAS No.	GW PMCL (µg/L)	GW PMCL x 100 (mg/kg)	Puget Sound Soil Background (mg/kg)	Soil PMCL (mg/kg)
Copper	7440-50-8	2.9	0.29	36.4	36.4
Cyanide	57-12-5	1	0.1	--	0.1
Iron	7439-89-6	NA <sup>a,d</sup>	--	--	NA <sup>a,d</sup>
Lead	7439-92-1	5.6	0.56	16.8	16.8
Magnesium	7439-95-4	NA <sup>c,d</sup>	--	--	NA <sup>c,d</sup>
Manganese	7439-96-5	NA <sup>a</sup>	--	1,146	1,146
Mercury	7439-97-6	0.025	0.0025	0.07	0.07
Molybdenum <sup>e</sup>	7439-98-7	NA <sup>a</sup>	--	--	NA <sup>a</sup>
Nickel	7440-02-0	8.3	0.83	38.2	38.2
Potassium	7440-09-7	NA <sup>a,d</sup>	--	--	NA <sup>a,d</sup>
Selenium	7782-49-2	71	7.1	--	7.1
Silver	7440-22-4	2.3	0.23	--	0.23
Sodium	7440-23-5	NA <sup>a,d</sup>	--	--	NA <sup>a,d</sup>
Thallium	7440-28-0	6.3	0.63	--	0.63
Tin <sup>e</sup>	7440-31-5	NA <sup>a</sup>	--	--	NA <sup>a</sup>
Vanadium	7440-62-2	648	64.8	--	64.8
Zinc	7440-66-6	86	8.6	85.1	85.1

NA: No appropriate promulgated standards or criteria exist.

<sup>a</sup> No RfD or slope factors exist to calculate a human health standard.

<sup>b</sup> No CLARC II value available, calculated value using WAC 173-340-730(3).

<sup>c</sup> Constituent does not bioconcentrate.

<sup>d</sup> Essential nutrient.

<sup>e</sup> Reference for GW PMCL provided in Appendix A.



Table 2—COCs That Exceed Proposed Media Cleanup Levels

Constituent	CAS Number	Number of Samples Analyzed	Proposed Media Cleanup Level (mg/kg)	Number of Samples > PMCL	Frequency (%)	Minimum Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)
<b>VOC</b>							
1,1,2-Trichloroethane	79-00-5	804	2.5	1	0.1	0.0017	3.3
1,1-Dichloroethene	75-35-4	804	0.19	2	0.2	0.001	1.7
Benzene	71-43-2	817	4.3	1	0.1	0.0005	49
Ethylbenzene	100-41-4	817	43	3	0.4	0.0005	260
Tetrachloroethene	127-18-4	804	0.89	4	0.5	0.0004	20
Toluene	108-88-3	817	500	1	0.1	0.0006	650
Trichloroethene	79-01-6	804	5.5	24	3.0	0.0007	11000
Vinyl Chloride	75-01-4	804	0.29	6	0.7	0.0019	18
<b>BNAs</b>							
2,4-Dimethylphenol	105-67-9	298	55.3	1	0.3	0.019	130
bis(2-Ethylhexyl)phthalate	117-81-7	298	0.35	16	5.4	0.0081	520
Di-n-butylphthalate	84-74-2	298	291	1	0.3	0.011	790
Naphthalene	91-20-3	349	235	2	0.6	0.013	520
Acenaphthylene	208-96-8	349	30	2	0.6	0.07	240
Fluorene	86-73-7	349	30	2	0.6	0.0001	180
Anthracene	120-12-7	349	30	2	0.6	0.0096	240
Total LPAH	TOTAL-LPAH	349	30	9	2.6	0.0085	2138
Fluoranthene	206-44-0	349	9	6	0.01	0.0085	410
Pyrene	129-00-0	349	30	7	2.0	0.0095	550
Benzo(a)anthracene	56-55-3	349	0.0029	32	9.2	0.021	200
Chrysene	218-01-9	349	0.0029	42	12.0	0.0079	240
Benzo(b)fluoranthene	205-99-2	349	0.0029	30	8.6	0.016	100
Benzo(k)fluoranthene	207-08-9	349	0.0029	33	9.5	0.015	160
Benzo(a)pyrene	50-32-8	349	0.0029	34	9.7	0.018	210
Indeno(1,2,3-cd)pyrene	193-39-5	349	0.0029	30	8.6	0.026	83
Dibenz(a,h)anthracene	53-70-3	349	0.0029	16	4.6	0.087	33
Total HPAH	TOTAL-HPAH	349	6.8	14	4.0	0.0181	2086
<b>Pesticides / PCBs</b>							
Aroclor 1248	12672-29-6	545	4.5E-06	15	2.8	0.035	90
Aroclor 1254	11097-69-1	545	4.5E-06	33	6.1	0.02	3
Aroclor 1260	11096-82-5	545	4.5E-06	76	13.9	0.015	310
Aroclor 1242	53469-21-9	161	4.5E-06	1	0.6	29	29
Aroclor 1016/1242	A1016/1242	384	4.5E-06	1	0.3	0.82	0.82
Aroclor 1262	37324-23-5	9	4.5E-06	9	100.0	0.022	1.6
Total PCB	TOTAL-PCB	581	1.04E-05	127	21.9	0.018	310
<b>Total Inorganics</b>							
Aluminum	7429-90-5	367	32.581	3	0.8	7110	180
Antimony	7440-36-0	482	0.05	7	1.5	5	0.576
Arsenic	7440-38-2	757	0.0073	58	7.7	0.73	0.076
Beryllium	7440-41-7	670	0.0006	7	1.0	0.1	0.0049
Cadmium	7440-43-9	794	0.0008	116	14.6	0.1	7.1
Chromium	7440-47-3	794	0.0482	120	15.1	1.6	72
Copper	7440-50-8	760	0.0364	93	12.2	0.8	28.1
Cyanide	CN	248	0.0001	102	41.1	0.11	4.6
Lead	7439-92-1	801	0.0168	107	13.4	0.917	17.3
Manganese	7439-96-5	389	1.146	3	0.8	66.5	3.17



Table 2—COCs That Exceed Proposed Media Cleanup Levels

Constituent	CAS Number	Number of Samples Analyzed	Proposed Media Cleanup Level (mg/kg)	Number of Samples > PMCL	Frequency (%)	Minimum Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)
Mercury	7439-97-6	727	0.00007	94	12.9	0.04	0.03
Nickel	7440-02-0	745	0.0382	60	8.1	1	1.77
Selenium	7782-49-2	701	0.0071	8	1.1	0.024	0.009
Silver	7440-22-4	721	0.00023	69	9.6	0.1	0.274
Thallium	7440-28-0	685	0.00063	59	8.6	0.044	0.056
Vanadium	7440-62-2	367	0.0648	16	4.4	29.1	0.101
Zinc	7440-66-6	761	0.0851	114	15.0	3.6	31



## FIGURES

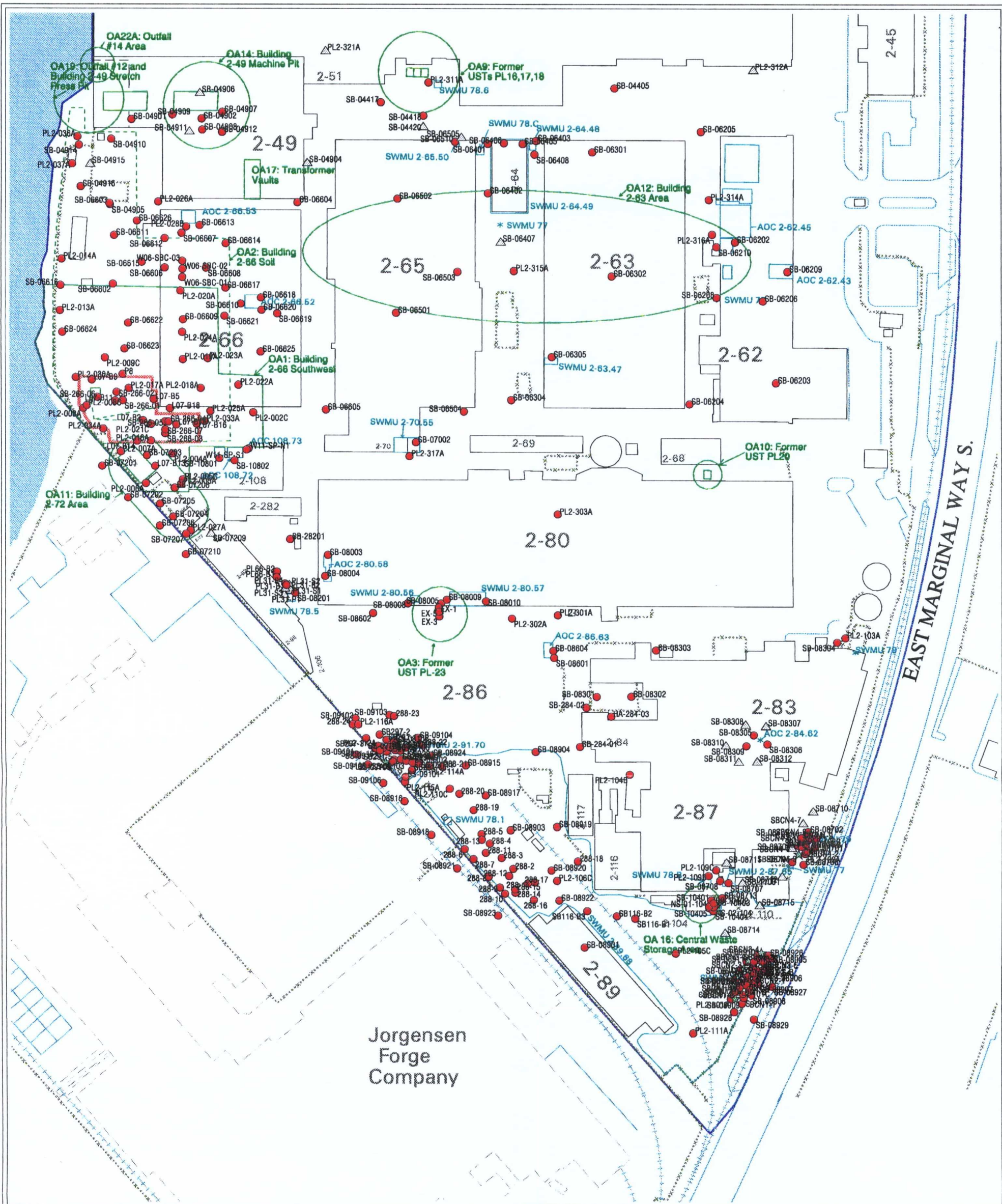












#### SYMBOL EXPLANATION

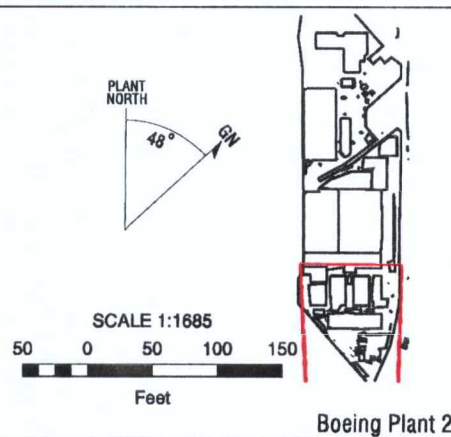
- △ Non-Detect
- ☆ Detected but not > reference concentration.
- Detected and > reference concentration.
- SWMU/AOC
- \* Approx. located SWMU/AOC
- Other Area
- Other Area

#### BASEMAP EXPLANATION

- N Facility Boundary
- N Building
- N SWMU/AOC
- N Non-Boeing Building
- N Building Bulkhead/Fill Boundary
- N Sheet Pile Alignment

#### NOTES

- 1) Historical and RFI Soil Depths: 0 - 12 feet



DATE: April 10, 1998 1:06 PM  
 JOB NUMBER: 03709-034-300-3930-00  
 LEAD GIS ANALYST: K. Palmer  
 VIEW FILE: default.view

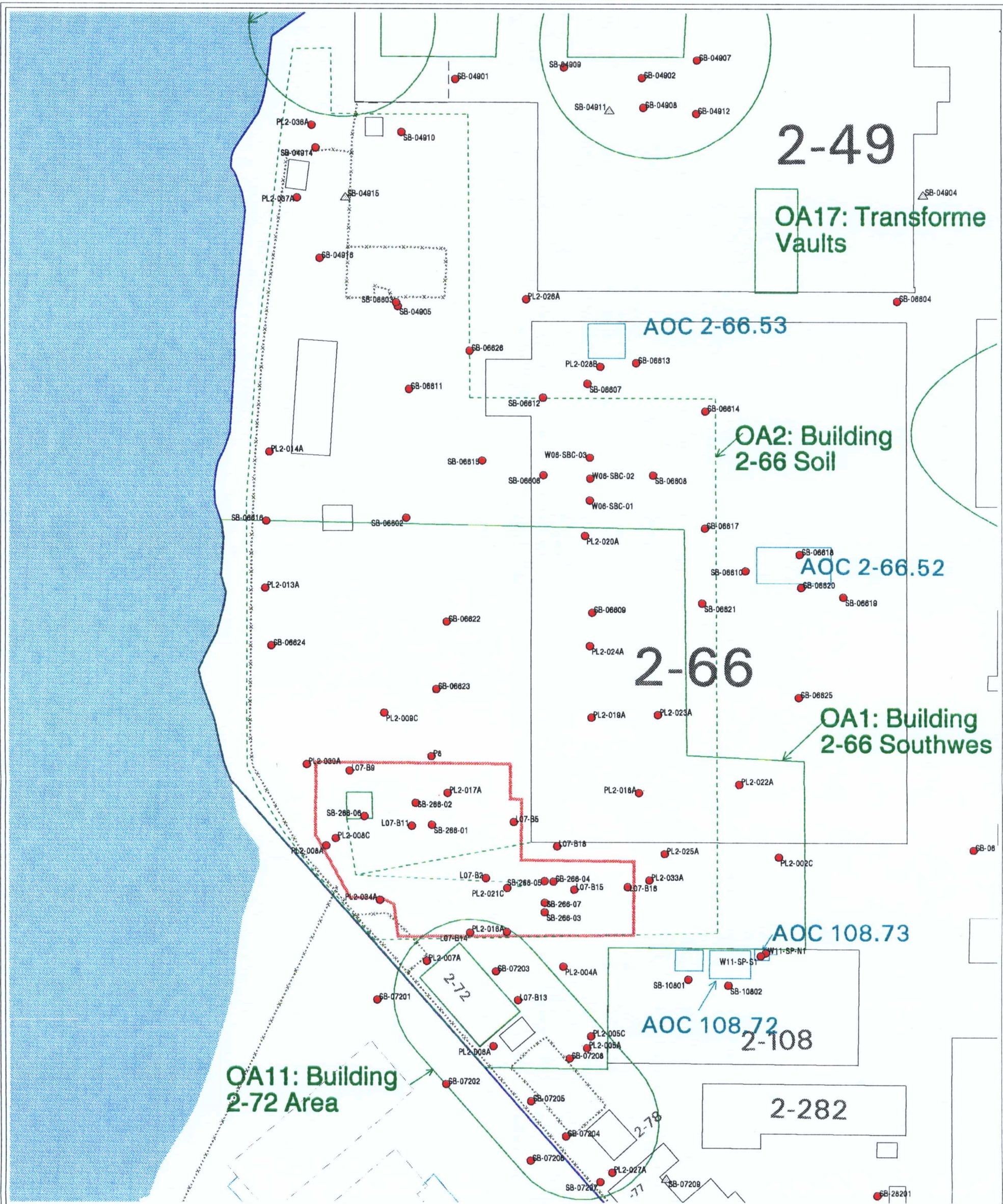
CHECKED BY: \_\_\_\_\_

APPROVED BY: \_\_\_\_\_

## Boeing Plant 2 Historical and RFI Soil Samples Exceeding Proposed Media Cleanup Levels

Figure  
1c



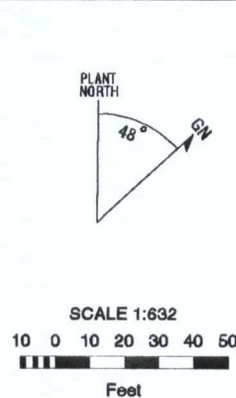


#### SYMBOL EXPLANATION

- △ Non-Detect
- ☆ Detected but not > reference concentration.
- Detected and > reference concentration.
- SWMU/AOC
- \* Approx. located SWMU/AOC
- Other Area
- Other Area

#### BASEMAP EXPLANATION

- Facility Boundary
- Building
- SWMU/AOC
- Non-Boeing Building
- Building Bulkhead/Fill Boundary
- Sheet Pile Alignment



Boeing Plant 2

#### NOTES

- 1) Historical and RFI Soil Depths: 0 - 12 feet



DATE: April 10, 1998 1:14 PM  
JOB NUMBER: 03709-034-300-3990-00  
LEAD GIS ANALYST: K. Palmer  
VIEW FILE: default.view

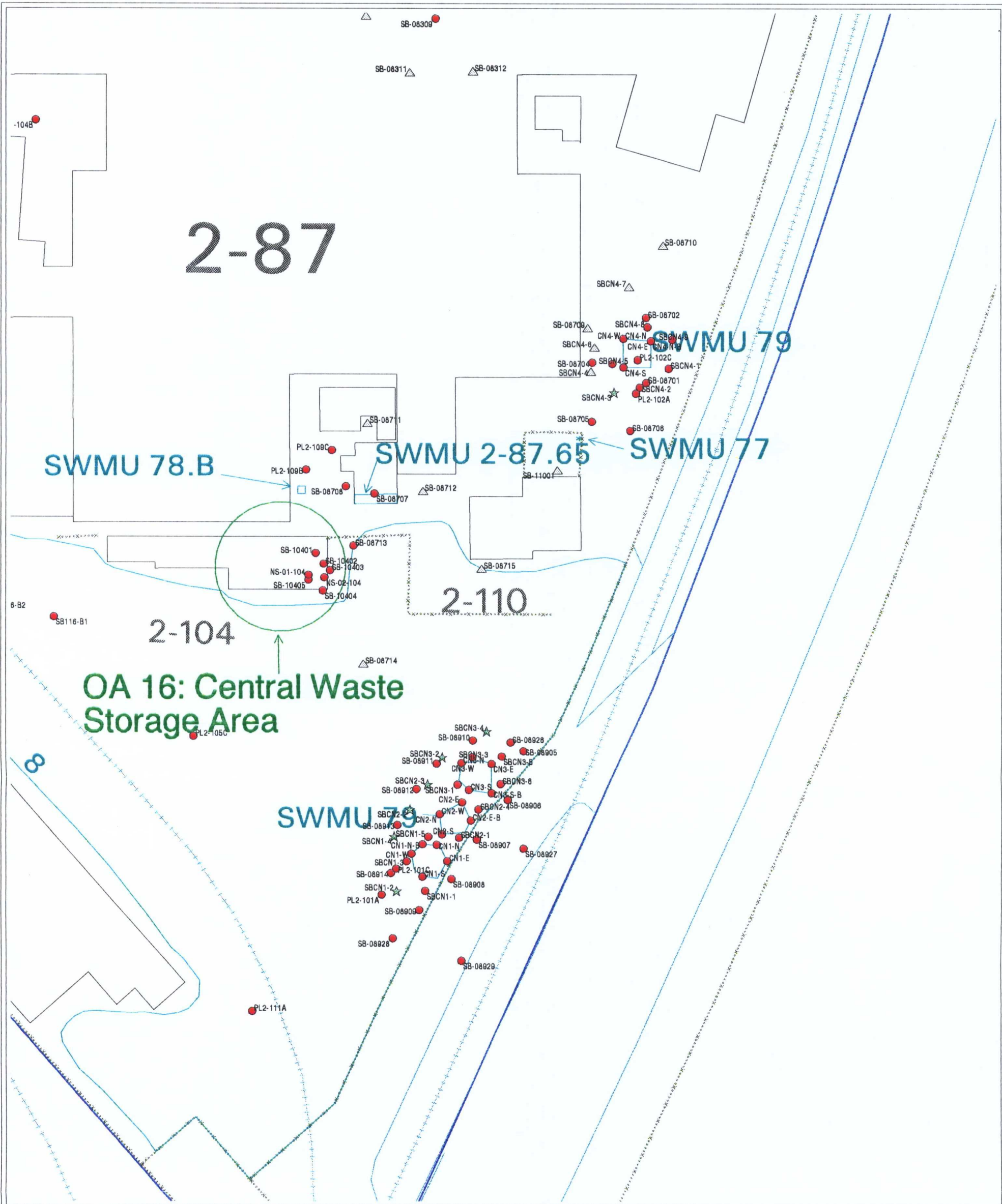
CHECKED BY: \_\_\_\_\_

APPROVED BY: \_\_\_\_\_

## Boeing Plant 2 Historical and RFI Soil Samples Exceeding Proposed Media Cleanup Levels

Figure  
1d





#### SYMBOL EXPLANATION

- △ Non-Detect
- ☆ Detected but not > reference concentration.
- Detected and > reference concentration.
- SWMU/AOC
- ☆ Approx. located SWMU/AOC
- Other Area
- Other Area

#### BASEMAP EXPLANATION

- Facility Boundary
- Building
- SWMU/AOC
- Non-Boeing Building
- Building Bulkhead/Fill Boundary
- Sheet Pile Alignment



Boeing Plant 2

#### NOTES

- 1) Historical and RFI Soil Depths: 0 - 12 feet

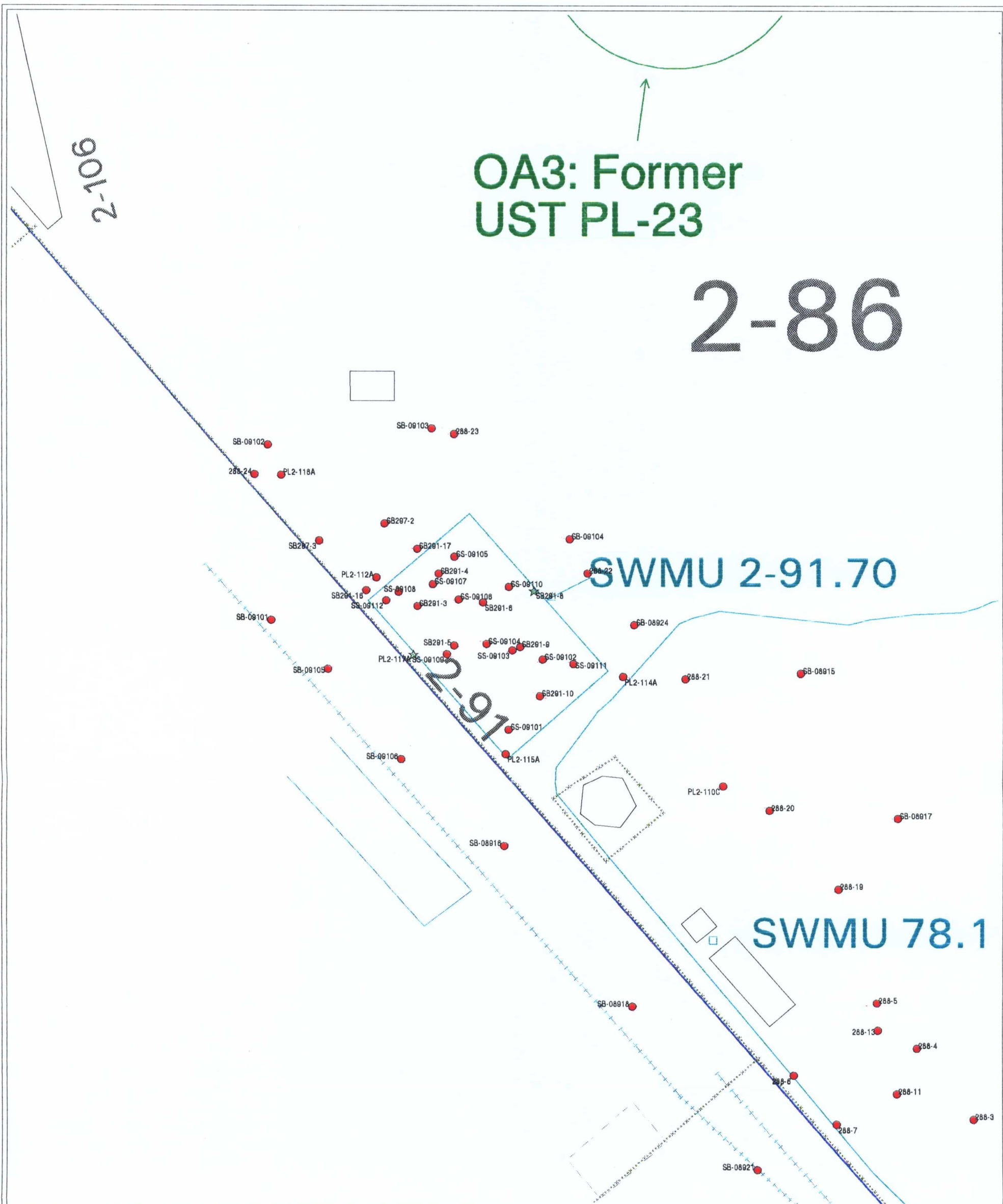


DATE: April 10, 1998 1:17 PM  
 JOB NUMBER: 03709-034-300-3930-00  
 LEAD GIS ANALYST: K. Palmer  
 VIEW FILE: default.view

CHECKED BY: \_\_\_\_\_  
 APPROVED BY: \_\_\_\_\_

## Boeing Plant 2 Historical and RFI Soil Samples Exceeding Proposed Media Cleanup Levels



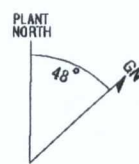


**SYMBOL EXPLANATION**

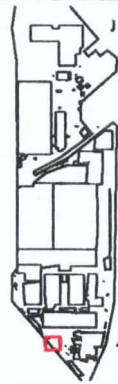
- △ Non-Detect
- ☆ Detected but not > reference concentration.
- Detected and > reference concentration.
- SWMU/AOC
- \* Approx. located SWMU/AOC
- Other Area
- Other Area

**BASEMAP EXPLANATION**

- Facility Boundary
- Building
- SWMU/AOC
- Non-Boeing Building
- Building Bulkhead/Fill Boundary
- Sheet Pile Alignment



SCALE 1:348  
5 0 5 10 15 20 25  
Feet



Boeing Plant 2

**NOTES**

- 1) Historical and RFI Soil Depths: 0 - 12 feet



DATE: April 10, 1998 1:20 PM  
JOB NUMBER: 03709-034-300-3930-00  
LEAD GIS ANALYST: K. Palmer  
VIEW FILE: default.view

CHECKED BY: \_\_\_\_\_  
APPROVED BY: \_\_\_\_\_

# Boeing Plant 2 Historical and RFI Soil Samples Exceeding Proposed Media Cleanup Levels



**APPENDIX A**

**SURFACE WATER CRITERIA SCREENING LEVELS**



**Table A-1—Surface Water Criteria Screening Levels**

Constituent	CAS No.	Environmental			Human Health		MTCA Method B	MTCA Method C
		Acute WQC (µg/L)	Chronic WQC (µg/L)	Comment	Criteria (µg/L)	Comment	CLARCI (February 1996) except as noted (µg/L)	
1,2-Dichloropropane	78-87-5	--	--	No promulgated criteria were available	--	No regulatory criteria 40 CFR 131 (7-1-97 edition)	23.2	580
2 Hexanone	591-78-6	--	--	No promulgated criteria were available	--	No regulatory criteria 40 CFR 131 (7-1-97 edition)	No BCF	No BCF
Styrene	100-42-5	--	--	No promulgated criteria were available	--	No regulatory criteria 40 CFR 131 (7-1-97 edition)	No BCF	No BCF
1,2,4-Trichlorobenzene	120-82-1	--	--	No promulgated criteria were available	--	No regulatory criteria 40 CFR 131 (7-1-97 edition)	227	569
2-Chloronaphthalene	91-58-7	--	--	No promulgated criteria were available	--	No regulatory criteria 40 CFR 131 (7-1-97 edition)	No BCF	No BCF
Benzoic acid	65-85-0	--	--	No promulgated criteria were available	--	No regulatory criteria 40 CFR 131 (7-1-97 edition)	No BCF	No BCF
Butylbenzylphthalate	85-68-7	--	--	No promulgated criteria were available	--	No regulatory criteria 40 CFR 131 (7-1-97 edition)	1250	3130
Di-n-butylphthalate	84-74-2	--	--	No promulgated criteria were available	12,000	40 CFR 131 (7-1-97 edition)	2910	7280
Dimethylphthalate	131-11-3	--	--	No promulgated criteria were available	2,900,000	40 CFR 131 (7-1-97 edition)	72000	180000
Hexachlorobutadiene	87-68-3	--	--	No promulgated criteria were available	50	40 CFR 131 (7-1-97 edition)	29.1	466
N-Nitrosodiphenylamine	86-30-6	--	--	No promulgated criteria were available	16	40 CFR 131 (7-1-97 edition)	9.73	243
Benzo(a)anthracene	56-55-3	--	--	No promulgated criteria were available	0.031	40 CFR 131 (7-1-97 edition)	0.029	74
Chrysene	218-01-9	--	--	No promulgated criteria were available	0.031	40 CFR 131 (7-1-97 edition)	0.029	74
Benzo(b)fluoranthene	205-99-2	--	--	No promulgated criteria were available	0.031	40 CFR 131 (7-1-97 edition)	0.029	74
Benzo(k)fluoranthene	207-08-9	--	--	No promulgated criteria were available	0.031	40 CFR 131 (7-1-97 edition)	0.029	74
Benzo(a)pyrene	50-32-8	--	--	No promulgated criteria were available	0.031	40 CFR 131 (7-1-97 edition)	0.029	74
Indeno(1,2,3-cd)pyrene	193-39-5	--	--	No promulgated criteria were available	0.031	40 CFR 131 (7-1-97 edition)	0.029	74
Dibenzo(a,h)anthracene	53-70-3	--	--	No promulgated criteria were available	0.031	40 CFR 131 (7-1-97 edition)	0.029	74



**Table A-1—Surface Water Criteria Screening Levels**

Constituent	CAS No.	Environmental			Human Health		MTCA Method B	MTCA Method C
		Acute WQC (µg/L)	Chronic WQC (µg/L)	Comment	Criteria (µg/L)	Comment	CLARCI (February 1996) except as noted (µg/L)	
Benzo(g,h,i)perylene	191-24-2	--	--	No promulgated criteria were available	--	No regulatory criteria 40 CFR 131 (7-1-97 edition)	No BCF	No BCF
Aroclor 1248	12672-29-6	10	0.03	Marine WQC-Total PCBs (WAC 173-201A)	0.000045	40 CFR 131 (7-1-97 edition)	No BCF	No BCF
Aroclor 1262	37324-23-5	10	0.03	Marine WQC-Total PCBs (WAC 173-201A)	0.000045	40 CFR 131 (7-1-97 edition)	No BCF	No BCF
Molybdenum	7439-98-7	--	--	No promulgated criteria were available	--	No regulatory criteria 40 CFR 131 (7-1-97 edition)	No BCF	No BCF
Tin	7440-31-5	--	--	No promulgated criteria were available	--	No regulatory criteria 40 CFR 131 (7-1-97 edition)	No BCF	No BCF

-- No data available for this constituent.